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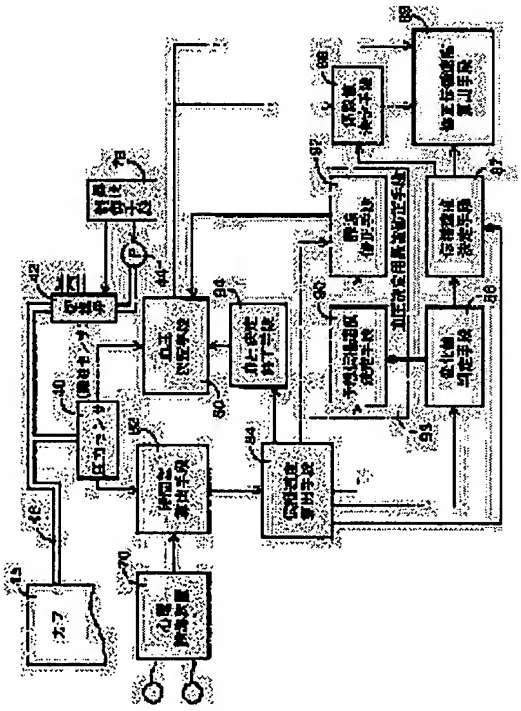
(54) AUTOMATIC SPHYGMOMANOMETER WITH MEASURING FUNCTION OF PULSE WAVE PROPAGATION VELOCITY

(57)Abstract:

PROBLEM TO BE SOLVED: To improve the accuracy on measurement or purse wave propagation velocity as possible in an automatic sphygmomanometer with a measuring function of pulse wave propagation velocity for determining a blood pressure of an organism based on heart beat synchronized signal generated from the organism in process for varying the pressure of a cuff wound on part of the organism.

SOLUTION: After induced wave forms of an organism is detected by an electrocardiograph apparatus 70 through electrodes attached to the organism and cuff wave forms of the organism are detected by a pressure sensor 40, a time difference TDRP till the down peak point of the pulse wave from R wave of the induced wave forms is determined by a time difference calculating means 82 and a propagation velocity VMI of cuff pulse wave is calculated by a propagation velocity calculating means 84 based on the time difference TDRP. Then, since the variation in the propagation velocity VM1 is judged to be lower than a given value by a variation decision means 86, a mean value of three pulses of the propagation velocity VM1 of cuff pulse wavesusccesively calculated, is decided to be a propagation velocity VM2 of the pulse wave propagating in artery of the organism by a propagation speed decision means 87.



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* NOTICES *

1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

CLAIMS

[Claim(s)]
[Claim 1] In automatic blood-pressure-measurement equipment with a pulse-wave-velocity measurement function of format of determining this living body's blood-pressure value based on a heartbeat synchronizing signal generated from this living body in a process in which compression pressure force of a cuff wound around some living bodies is changed An electrocardio guide which detects this living body's electrocardio induction wave through an electrode contacted by said living body, A pulse wave sensor which detects a pulse wave generated in this cuff in a process in which compression pressure force of said cuff is changed, A time difference calculation means which starts and computes time difference to a part to generate for every period of a pulse wave detected by said pulse wave sensor from a predetermined part generated for every period of an electrocardio induction wave detected with said electrocardio guide, A propagation velocity calculation means to compute propagation velocity of this pulse wave based on time difference computed by this time difference calculation means, A change value judging means to judge whether change to said cuff pressure of propagation velocity of this pulse wave computed by this propagation velocity calculation means became below a predetermined value, It is based on at least one of two or more propagation velocity judged as change to said cuff pressure of propagation velocity of this pulse wave being below a predetermined value by this change value judging means. Automatic blood-pressure-measurement equipment with a pulse-wave-velocity measurement function characterized by including a propagation velocity decision means to determine propagation velocity of a pulse wave which spreads the inside of said living body's artery.
[Claim 2] Said propagation velocity decision means is automatic blood-pressure-measurement equipment with a pulse-wave-velocity measurement function according to claim 1 which is what determines propagation velocity of a pulse wave which spreads the inside of said living body's artery from the average computed based on two or more propagation velocity judged as change to said cuff pressure of propagation velocity of this pulse wave being below a predetermined value by this change value judging means.

[Translation done.]

DETAILED DESCRIPTION

[Detailed Description of the Invention]
[0001]
[The technical field to which invention belongs] This invention is the process in which the compression pressure force of the cuff wound around some living bodies is changed, and relates to the automatic blood-pressure-measurement equipment with a pulse-wave-velocity measurement function of the format of determining a living body's blood-pressure value, based on the heartbeat synchronizing signal generated from a living body.
[0002]
[Description of the Prior Art] The pressure of the compression pressure force of the cuff wound around some living bodies is made to lower gently at predetermined speed as equipment which measures a living body's blood-pressure value. The automatic blood-pressure-measurement equipment of the Korotkoff-sounds method which determines a blood-pressure value based on generating of the Korotkoff sounds generated in this **** pressure-lowering process, and the cuff pressure at the time of disappearance, The automatic blood-pressure-measurement equipment which determines a blood-pressure value with the oscillograph metric method which could be based on change of the pulse synchronous wave amplitude generated in the **** pressure-lowering process, and was learned is known. As automatic blood-pressure-measurement equipment of an oscillograph metric method, the automatic blood-pressure-measurement equipment indicated by JP,6-292660,A is mentioned, for example.
[0003] By the way, as opposed to the above automatic blood-pressure-measurement equipments, the right arm of the operating personnel-ed projected from said cuff is supported. And the 1st armrest with which the electrocardio electrode for electrocardio induction wave detection was prepared in the point is inclined and formed upward in the direction of the back of a cuff. Moreover, by forming the 2nd armrest with which the left arm of an operating personnel-ed was supported, and the electrocardio electrode for electrocardio induction wave detection was prepared in the point in the shape of a horizontal in the left-hand side of a main part From the predetermined part generated for every period of the electrocardio induction wave detected by blood pressure measurement and coincidence from the wrist of the right arm of an operating personnel-ed, and the wrist of the left arm The automatic blood-pressure-measurement equipment with a pulse-wave-velocity measurement function which can also measure the propagation velocity of the pulse wave which starts, computes the time difference to a part and spreads the inside of a living body's artery based on the time difference generated for said every pulse synchronous wave period is considered.
[0004] According to such automatic blood-pressure-measurement equipment with a pulse-wave-velocity measurement function, since pulse wave velocity is also measured by blood pressure measurement and coincidence, it becomes possible to evaluate continuously the degree which the symptom has improved by alimentary therapy etc. also to the chronic hypertensive which has taken the antihypertensive daily based on the known fact of having relation with whenever [pulse wave velocity and whenever / arteriosclerosis / of an operating personnel-ed / close], for example.
[0005]
[Problem(s) to be Solved by the Invention] However, the pulse wave velocity measured by such automatic blood-pressure-measurement equipment with a pulse-wave-velocity measurement function In the period which has the compression pressure force of a cuff beyond the mean-blood-pressure value of an operating personnel-ed, and the pressure value of an abbreviation EQC Since it is increased so that the compression pressure force of a cuff declines, if pulse wave velocity is measured from the electrocardio induction wave detected at the suitable time, without taking into consideration change of the compression pressure force of a cuff, and pulse synchronization voltage, the reliability of the accuracy of measurement will be remarkably missing.
[0006] The place which succeed in this invention against the background of the above situation , and be make into the purpose be the process in which the compression pressure force of the cuff wound around some living bodies be

change , and be in the automatic blood pressure measurement equipment with a pulse wave velocity measurement function of the format of determine a living body blood pressure value , based on the heartbeat synchronizing signal generate from a living body to raise the accuracy of measurement of pulse wave velocity as much as possible .
[0007]
[Means for Solving the Problem] A place made into a summary of this invention for attaining the above-mentioned purpose In automatic blood-pressure-measurement equipment with a pulse-wave-velocity measurement function of format of determining a living body's blood-pressure value based on a heartbeat synchronizing signal generated from a living body in a process in which compression pressure force of a cuff wound around some living bodies is changed (a) in a process in which an electrocardio guide which detects this living body's electrocardio induction wave through an electrode contacted by said living body, and compression pressure force of the (b) aforementioned cuff are changed From a pulse wave sensor which detects a pulse wave generated in a cuff, and a predetermined part generated for every period of an electrocardio induction wave detected with the (c) aforementioned electrocardio guide A time difference calculation means which starts and computes time difference to a part to generate for every period of a pulse wave detected by said pulse wave sensor, (d) A propagation velocity calculation means to compute propagation velocity of a pulse wave based on time difference computed by time difference calculation means, (e) A change value judging means to judge whether change to said cuff pressure of propagation velocity of a pulse wave computed by propagation velocity calculation means became below a predetermined value, (f) It is in including a propagation velocity decision means to determine propagation velocity of a pulse wave which spreads the inside of said living body's artery, based on at least one of two or more propagation velocity judged as change to said cuff pressure of propagation velocity of a pulse wave being below a predetermined value by change value judging means.
[0008]
[Effect of the Invention] In the process in which a living body's electrocardio induction wave will be detected by the electrocardio guide through the electrode contacted by the living body, and the compression pressure force of a cuff will be changed if it does in this way If a living body's pulse wave is detected by the pulse wave sensor, from the predetermined part generated for every period of an electrocardio induction wave with a time difference calculation means The time difference to the standup part generated for every period of a pulse wave is computed, and the propagation velocity of the pulse wave is computed based on the time difference by the propagation velocity calculation means. And based on at least one of the propagation velocity of two or more pulse waves judged as the change to said cuff pressure of this propagation velocity being below a predetermined value by the change value judging means, the propagation velocity of the pulse wave which spreads the inside of a living body's artery with a propagation velocity decision means is determined. Therefore, it is not concerned with change of the compression pressure force of a cuff, but since the pulse wave velocity in a field as the pulse wave velocity computed serially always shows abbreviation constant value in is finally determined as pulse wave velocity, the accuracy of measurement of pulse wave velocity is raised.
[0009]
[Other modes of invention] Said propagation velocity decision means is characterized by being what determines the propagation velocity of the pulse wave which spreads the inside of said living body's artery from the average computed based on two or more propagation velocity judged as the change to said cuff pressure of the propagation velocity of a pulse wave being below a predetermined value by said change value judging means still more suitably. If it does in this way, compared with the case where one suitable propagation velocity in two or more propagation velocity judged as the change to said cuff pressure of propagation velocity being below a predetermined value is determined as final propagation velocity, the accuracy of measurement of pulse wave velocity will be raised more.
[0010]
[Embodiment of the Invention] Hereafter, one example of this invention is explained to details based on a drawing. Drawing 1 is the perspective diagram showing automatic blood-pressure-measurement equipment 8 with a pulse-wave-velocity measurement function.
[0011] In drawing 1 , the through hole 14 for inserting the right arm 12 of an operating personnel-ed is formed in the box 10, and the belt 16 held in the shape of a cylinder in preparation for inner skin in the cuff 15 which consists of a saccate flexible cloth and a saccate rubber bladder is arranged in the through hole 14. Moreover, the 1st armrest 17 for supporting the right arm 12 of the operating personnel-ed projected from the through hole 14 is inclined and formed upward, and in order to detect the electrocardio induction wave generated with the activity of the heart of an operating personnel-ed, it is arranged in the direction of the back of a through hole 14 by the point of the 1st armrest 17 so that an electrode 18 may contact the wrist of the right arm 12 of an operating personnel-ed good. In addition, this 1st armrest 17 is equipped with the optimal back-face configuration which, on the whole, supports while resulting [from an elbow] in

a wrist so that an always exact electrocardio induction wave can be detected from the wrist of an operating personnel-ed, and it may be maintained at the condition that muscles until it results [from the elbow of the right arm 12 of an operating personnel-ed] in a wrist loosened continuously. Moreover, on the left-hand side of the box 10, the 2nd armrest 19 for supporting the left arm 13 of an operating personnel-ed is formed, and in order to detect the electrocardio induction wave of an operating personnel-ed similarly, it is arranged by the point of the 2nd armrest 19 so that an electrode 18 may contact the wrist of the left arm 13 of an operating personnel-ed. In addition, this 2nd armrest 19 is also equipped with the optimal back-face configuration which, on the whole, supports while resulting [from an elbow] in a wrist so that the condition that muscles until it results [from the elbow of the left arm 13 of an operating personnel-ed] in a wrist like the 1st armrest 17 loosened continuously can be maintained. A start switch 22, a safety switch 24, a printer 26, a card slot 28, etc. are arranged by the control panel 20 of a box 10, and the highest-blood-pressure drop 32, the lowest-blood-pressure drop 34, the pulse numeral machine 36, and the time stamp machine 38 are arranged by the display panel 30, respectively.

[0012] Drawing 2 is a block diagram explaining the circuitry of the above-mentioned automatic blood-pressure-measurement equipment 8. In drawing, the cuff 15 is connected with the pressure sensor 40, the change-over valve 42, and the air pump 44 through piping 46, and this change-over valve 42 is constituted so that it may be switched to three conditions, the pressure supply condition of permitting supply of the pressure into a cuff 15, the **** exhaust-gas-pressure condition which carries out exhaust gas pressure of the inside of a cuff 15 gradually, and the rapid exhaust-gas-pressure condition which carries out exhaust gas pressure of the inside of a cuff 15 quickly. Moreover, the end of the belt 16 around which the cuff 15 was wound in the shape of a cylinder in preparation for inner skin is fixed, and the other end is constituted so that it may be tightened on the drum 50 driven with DC motor 48 with a reducer. A pressure sensor 40 supplies the pressure signal SP with which the pressure in a cuff 15 is detected and the pressure is expressed to the static pressure discriminator 52 and the pulse wave discriminator 54, respectively.

[0013] The above-mentioned static pressure discriminator 52 is equipped with a low pass filter, discriminates from the cuff pressure signal SK showing steady pressure, i.e., cuff pressure, contained in the pressure signal SP, and supplies the cuff pressure signal SK to an electronic control 58 through A/D converter 56. Moreover, it is the pulse wave signal SM 1 which the above-mentioned pulse wave discriminator 54 is equipped with a band pass filter, and is the oscillating component of the pressure signal SP. It discriminates in frequency and is the pulse wave signal SM 1. An electronic control 58 is supplied through A/D converter 60. This pulse wave signal SM 1 The cuff pulse wave to express is a pressure oscillatory wave which occurs from the brachial artery which is not illustrated synchronizing with the heartbeat of an operating personnel-ed, and is transmitted to a cuff 15, and the above-mentioned cuff 15, the pressure sensor 40, and the pulse wave discriminator 54 are functioning as a pulse wave sensor.

[0014] the above-mentioned electronic control 58 consists of so-called microcomputers equipped with CPU62, ROM64, RAM66, the I/O Port that is not a drawing example, and using the temporary storage function of RAM66, it processes an input signal according to the procedure beforehand memorized by ROM64, and CPU62 outputs a driving signal, a status signal, etc. Blood pressure measurement is faced. Namely, CPU62 A cuff 15 in a living body's overarm section by driving DC motor 48 with a reducer according to the procedure defined beforehand Winding, The overarm section is pressed by the cuff 15 by driving an air pump 44. Subsequently, drive a change-over valve 42 and the pressure of the compression pressure force of a cuff 15 is made to lower gradually. Pulse wave signal SM 1 acquired in the **** pressure-lowering process And based on the cuff pressure signal SK, an oscillograph metric method determines a blood-pressure value. The blood-pressure value storage region 69 of storage 68 is made to carry out sequential storage at the same time it displays the blood-pressure value on the highest-blood-pressure drop 32 and the lowest-blood-pressure drop 34. In addition, this storage 68 is constituted by the storage good [a magnetic disk a magnetic tape, volatile semiconductor memory, or / non-volatile] and known.

[0015] The electrocardio guide 70 lets the electrode 18 of the pair contacted at the wrist of the right arm 12 of an operating personnel-ed, and the wrist of the left arm 13 pass, detects continuously the electrocardio induction wave which shows the action potential of a myocardium, and the so-called electrocardiogram, and supplies the signal which shows the electrocardio induction wave to said electronic control 58.

[0016] Drawing 3 is a functional block diagram explaining the important section of the control function of the electronic control 58 in the above-mentioned automatic blood-pressure-measurement equipment 8. In drawing, the pressure-up control means 78 first a change-over valve 42 by driving a switch and an air pump 44 in the pressure supply condition The pressure up of the compression pressure force of a cuff 15 is quickly carried out to the predetermined aim cuff pressure value P1 (for example, pressure value of a 180mmHg degree). Then, after blood-pressure-measurement termination carries out [by switching a change-over valve 42 to a **** exhaust-gas-pressure condition] rapid exhaust gas pressure of the compression pressure force of a cuff 15 by switching a change-over valve 42 to a rapid exhaust-gas-

pressure condition by making the pressure of the compression pressure force of a cuff 15 lower gradually. In the **** pressure-lowering process in which the compression pressure force of a cuff 15 is dropped gently, the blood-pressure decision means 80 determines the highest-blood-pressure value SBP and the lowest-blood-pressure value DBP of an operating personnel-ed by the oscillometric method which could be based on change of the amplitude of the cuff pulse wave extracted by the pulse wave discriminator 54 through a pressure sensor 40 (equivalent to a pulse wave sensor), and was known, and computes a pulse rate HR based on the recurrence interval of a cuff pulse wave.

[0017] The time difference calculation means 82 computes serially the time difference TDRP to the predetermined part generated for every period of the electrocardio induction wave which is generated for every period of said cuff pulse wave serially detected by the pressure sensor 40, and which starts and is serially detected with said electrocardio guide 70 from a part, for example, the time difference from the R wave of an electrocardio induction wave as shown in drawing 4 to the bottom peak point of a cuff pulse wave. In addition, if the point that only predetermined amplitude value recovered from the bottom peak point besides the bottom peak point of the above, or the point (equivalent to the maximum peak point of a differential wave of a cuff pulse wave) of a cuff pulse wave inclining [maximum] corresponds and another word is carried out, predetermined points other than the maximum point of a cuff pulse wave support the standup part of a cuff pulse wave. And with the propagation velocity calculation means 84, the propagation velocity VM 1 (m/sec) of said cuff pulse wave is computed based on the actually computed above-mentioned time difference TDRP from the formula 1 set up beforehand. In a formula 1, L is the distance (m) to the press part of said pressure sensor 40 through the ventriclus sinister to a main artery, and it is TPEP. It is a precursive appearance period (sec) from the R wave of an electrocardio induction wave to the bottom peak point of a cuff pulse wave. such distance L and precursive appearance period TPEP **** -- the value calculated experimentally beforehand is used.

[0018]

[Equation 1] VM1=L/(TDRP-TPEP)

[0019] The change value judging means 86 judges whether the mutual change value, i.e., the variation, or mutual rate of change of propagation velocity VM 1 of the cuff pulse wave serially computed by the propagation velocity calculation means 84 became 3% or less below the predetermined value (below 0.1 [for example,] (m/sec)). The mutual change value of the propagation velocity VM 1 of a cuff pulse wave the propagation velocity decision means 87 with the change value judging means 86 out of the field judged that became below a predetermined value (equivalent to a part for a horizontal level among the propagation velocity VM 1 expressed to drawing 5) The average for three beats is determined as propagation velocity VM 2 of the pulse wave which spreads the inside of said living body's artery from the beginning of the propagation velocity VM 1 of the cuff pulse wave computed by the propagation velocity calculation means 84.

[0020] Furthermore, with the correction propagation velocity calculation means 89, the correction propagation velocity VM 3 (m/sec) of said cuff pulse wave corrected to the fixed blood-pressure value BPt (for example, 80mmHg(s)) by which it was beforehand set up from the formula 2 memorized beforehand based on the lowest-blood-pressure value DBP and pulse rate HR which were determined by said blood-pressure decision means 74, and the value in a pulse rate HRt (for example, 70BPM(s)) (normalization) is computed. In a formula 2, a coefficient A is a coefficient value which is beforehand determined by the coefficient value decision means 88 based on a formula 3, is proportional to propagation velocity VM 2, and changes in inverse proportion to the lowest-blood-pressure value DBP. The constants B, C, and D of a formula 3 and the constant E of a formula 2 are called for experimentally beforehand here.

[0021]

[Equation 2] VM3=VM2+A(BPt -DBP)+E(HRt -HR)

[0022]

[Equation 3] A=BVM2-C(DBP)+D [0023] Moreover, with the change value judging means 86, after judging that the mutual change value of the propagation velocity VM 1 of a cuff pulse wave became below a predetermined value, the anticipation propagation velocity decision means 90 Based on the propagation velocity VM 1 of two or more cuff pulse waves serially computed by the propagation velocity calculation means 84, anticipation propagation velocity VM1' (equivalent to ** mark of drawing 5) it is expected to be to be computed next by the propagation velocity calculation means 84 is determined based on a formula 4. difference deltaVM1 with the propagation velocity VM 1 (equivalent to - mark of drawing 5) of the cuff pulse wave by which the pulse wave correction means 92 was actually computed with this anticipation propagation velocity VM1' and the propagation velocity calculation means 84 -- that is Based on difference deltaVM1 computed from a formula 5, only the amplitude value X1 computed from the formula 6 set up beforehand [whether the amplitude value to make add to the amplitude value of the cuff pulse wave by which this propagation velocity VM 1 was computed, namely, to be shown in the amplitude value shown in drawing 6 as a continuous line with a dashed line is made to add, and] or pressure value X2 computed from the formula 7 set up

beforehand only -- it is made to add to the pressure value in the cuff 15 at the time of the cuff pulse wave by which this propagation velocity VM 1 was computed occurring -- That is, the cuff pulse wave used for the blood-pressure decision means 80 is correctly corrected by moving the cuff pulse wave shown in drawing 6 as a continuous line to the location shown with a dashed line. Here, the constants F and G of formulas 6 and 7 are called for experimentally beforehand. Moreover, said pulse wave correction means 93 for blood-pressure decision consists of said anticipation propagation velocity decision means 90 and said pulse wave correction means 92.

[0024]

[Equation 4] VM1'=[(VM1) i-n+ ... +(VM1) i-1+(VM1) i]/(n+1)

[0025]

[Equation 5] deltaVM1=VM1'-VM1 [0026]

[Equation 6] X1 =F (deltaVM1)

[0027]

[Equation 7] X2 =-G (deltaVM1)

[0028] The blood-pressure decision termination means 94 terminates the blood-pressure decision by the blood-pressure decision means 80, when the propagation velocity VM 1 of the cuff pulse wave serially computed by the propagation velocity calculation means 84 exceeds the field in the predetermined tolerance which the propagation velocity VM 1 beforehand set up for every pressure value in a cuff 15 can take, i.e., the dashed line of drawing 5 . By the usual blood pressure measurement, propagation velocity VM 1 is the range which cannot be taken by any means, and this tolerance is called for experimentally beforehand.

[0029] Drawing 7 is a flow chart explaining the important section of control actuation of the above-mentioned electronic control 58. At the step SA 1 (a step is skipped hereafter.) of drawing, it is judged whether the magnetic card 74 was inserted in the card slot 28 of card read in equipment 72. When decision of this step SA 1 is denied, this routine is terminated, but when affirmed, ID signal recorded on the magnetic card 74 in SA2 is read.

[0030] In continuing SA3, it is judged whether read ID signal is beforehand registered into the storage region of storage 68. When decision of this SA3 is denied (i.e., when having not registered ID signal recorded on the magnetic card 74), below-mentioned SA16 is performed and a magnetic card 74 is sent out from a card slot 28. However, when decision of this SA3 is affirmed (i.e., when ID signal recorded on the magnetic card 74 is registered), it is judged whether in continuing SA4, the start switch 22 for blood pressure measurement was operated.

[0031] It is made to stand by until it is affirmed that decision of this SA4 is denied. However, when decision of this SA4 is affirmed, SA5 and SA6 corresponding to the pressure-up control means 78 are performed. First, in SA5, after a pressure up is carried out to the aim cuff pressure P1 to which the change-over valve 42 was switched to the pressure supply condition, and the air pump 44 drove, and cuff pressure P was set beforehand (for example, pressure which is a 180mmHg degree), an air pump 44 is stopped. Subsequently, in SA6, **** pressure lowering in a cuff 15 is started by switching a change-over valve 42 to a **** exhaust-gas-pressure condition.

[0032] Then, it sets to SA7 and is the pulse wave signal SM 1. It is judged whether it was read and one beat of pulse waves was detected. When this decision is denied, repeat activation of SA7 is carried out, but when affirmed, the blood-pressure value decision routine of SA8 corresponding to the blood-pressure decision means 80 is performed. In this blood-pressure value decision routine, the blood-pressure value decision algorithm of an oscillograph metric method well known based on change of the amplitude of the pulse wave serially detected in the **** pressure-lowering process of cuff pressure P is followed, and they are the highest-blood-pressure value SBP 1, the lowest-blood-pressure value DBP1, and the mean-blood-pressure value MBP1. While being determined, it is based on a pulse wave recurrence interval, and it is a pulse rate HR 1. It is determined.

[0033] Next, it sets to SA9 and is the highest-blood-pressure value SBP 1. And lowest-blood-pressure value DBP1 It is judged whether it was determined or not. When this decision is denied, repeat activation of SA7 thru/or SA9 is carried out. However, the above-mentioned highest-blood-pressure value SBP 1 and the lowest-blood-pressure value DBP1 which were measured in continuing SA10 when this decision was affirmed, the mean-blood-pressure value MBP1, and a pulse rate HR 1 While measurement time is memorized for every operating personnel-ed in the blood-pressure value storage region 69 of storage 68, it is displayed on the highest-blood-pressure drop 32, the lowest-blood-pressure drop 34, and the pulse numeral machine 36, respectively.

[0034] Then, in SA11 corresponding to the propagation velocity decision means 87, the propagation velocity VM 2 of a cuff pulse wave is determined by computing the average of the propagation velocity VM 1 for three beats from the beginning among the propagation velocity VM 1 memorized in the 2nd storage region of RAM66 mentioned later. And in SA12 corresponding to the continuing coefficient value decision means 88, the coefficient A in the formula 2 memorized beforehand is determined based on the lowest-blood-pressure value DBP determined from the formula 3

memorized beforehand in the propagation velocity VM2 and SA8 determined in SA11.
[0035] Then, fixed blood-pressure value BPt to which the above-mentioned cuff pulse wave was beforehand set from the formula 2 memorized beforehand based on the lowest-blood-pressure value DBP and pulse rate HR which were measured in SA8 in SA13 corresponding to the correction propagation velocity calculation means 89 Pulse rate HRt The correction propagation velocity VM 3 which was corrected to the value which can be set, namely, was normalized is computed.
[0036] Then, in SA14 corresponding to the pressure-up control means 78, the rapid exhaust gas pressure in a cuff 15 is started by switching a change-over valve 42 to a rapid exhaust-gas-pressure condition. and continuing SA15 is shown in drawing 9 -- as -- said highest-blood-pressure value SBP 1 etc. -- a display output is carried out on the recording paper 100 by the printer 26. That is, while the name 102 of an operating personnel-ed is displayed on the location of the upper left on the recording paper 100, a sequential indication of the list 104 of whenever [measurement time blood-pressure value, pulse rate, and arteriosclerosis / that is determined according to drawing 10 from said correction propagation velocity VM 3] and the trend graph 106 is given at the bottom. As the decision method of whenever [this arteriosclerosis], it determines, for example based on a table like drawing 10 by choosing the value of whenever [predetermined arteriosclerosis] according to the value of the computed correction propagation velocity VM 3. In addition, as for the artery of an operating personnel-ed, ductility is lost, so that this table is determined experimentally beforehand and the value of whenever [arteriosclerosis] becomes large. In this trend graph 106, - mark which shows whenever [** mark / which shows **** which shows a highest-blood-pressure value and a lowest-blood-pressure value to upper limit and each lower limit, and a pulse rate /, and arteriosclerosis] is displayed in accordance with the horizontal axis 108, i.e., a time-axis, corresponding to the blood-pressure-measurement time. And a magnetic card 74 is sent out from a card slot 28 by performing continuing SA16.
[0037] Drawing 8 is a flow chart which shows the interruption routine performed to the main routine of drawing 7 when the R wave of an electrocardio induction wave is detected. In drawing 8 , the time of day when the R wave of an electrocardio induction wave occurred is read in SB1. Next, it sets to SB2 and is the pulse wave signal SM 1. It is judged whether the bottom peak point was detected. It sets to SB3 which continues when this decision is affirmed, although SB2 is succeedingly repeated when this decision is denied, and is the pulse wave signal SM 1. The time of day when the bottom peak point occurred is read.
[0038] Next, in SB4 corresponding to said time difference calculation means 82, as shown in drawing 4 , the time difference TDRP from the R wave of an electrocardio induction wave to the bottom peak point of a cuff pulse wave is computed. Then, in SB5 corresponding to said propagation velocity calculation means 84, while the propagation velocity VM 1 of the above-mentioned cuff pulse wave is computed based on the time difference TDRP actually searched for in SB4 from the formula 1 memorized beforehand, it memorizes temporarily in the 1st storage region of RAM66.
[0039] Next, in SB6 corresponding to the blood-pressure decision termination means 94, it is judged whether the propagation velocity VM 1 of the cuff pulse wave computed in SB5 exceeded the predetermined tolerance which the propagation velocity VM 1 set up beforehand can take. That is, it is judged whether this propagation velocity VM 1 exceeded the maximum-permissible curve expressed with the dashed line of drawing 4 or the minimum permission curve. By performing SB7 corresponding to the pressure-up control means 78 in order to perform remeasuring again, since the determined blood-pressure value is clearly doubtful when this decision is affirmed While a change-over valve 42 is switched to a rapid exhaust-gas-pressure condition and the rapid exhaust gas pressure in a cuff 15 is started, in SB8, the display output of the display of the purport which should measure again is carried out on the recording paper 100 by the printer 26, and a magnetic card 74 is sent out from a card slot 28 in SB9.
[0040] however, when decision of this SB6 is denied A mutual change value with the propagation velocity VM 1 computed in front of 1 period memorized in SB10 corresponding to the continuing change value judging means 86 in the 1st storage region of the propagation velocity VM1 and RAM66 computed in SB5, That is, it is judged whether variation or rate of change became 3% or less below the predetermined value (below 0.1 [for example,] (m/sec)). When this decision is affirmed, in continuing SB11, the propagation velocity VM 1 computed in SB5 is temporarily memorized in the 2nd storage region of RAM66. And in SB12 corresponding to the anticipation propagation velocity decision means 90, based on two or more propagation velocity VM 1 memorized in the 2nd storage region of this RAM66, anticipation propagation velocity VM1' (equivalent to ** mark of drawing 4) of the cuff pulse wave it is expected to be to be computed next is determined, and it memorizes temporarily in the 3rd storage region of RAM66 from a formula 4.
[0041] However, when decision of this SB10 is denied Anticipation propagation velocity VM1' determined using the propagation velocity VM 1 computed in SB13 corresponding to the continuing pulse wave correction means 92 in front

of 1 period memorized as the newest thing in the 3rd storage region of RAM66 (equivalent to ** mark of drawing 4), difference deltaVM1 with the propagation velocity VM 1 (equivalent to - mark of drawing 4) of this cuff pulse wave computed in SB5 -- that is amplitude value X1 computed from the formula 6 set up beforehand based on difference deltaVM1 computed from a formula 5 only -- or [being added to the amplitude value of the cuff pulse wave by which this propagation velocity VM 1 was computed] -- or pressure value X2 computed from the formula 7 set up beforehand only -- correction of the cuff pulse wave used for said blood-pressure decision means 80 is made by being added to the pressure value in the cuff 15 at the time of generating of the cuff pulse wave by which this propagation velocity VM 1 was computed.

[0042] As mentioned above, if according to this example a living body's electrocardio induction wave is detected by the electrocardio guide 70 through the electrode 18 contacted by the living body and a living body's cuff pulse wave is detected by the pressure sensor 40 (equivalent to a pulse wave sensor) In SB4 corresponding to the time difference calculation means 82, the time difference TDRP from the R wave of an electrocardio induction wave to the bottom peak point of a cuff pulse wave is computed, and the propagation velocity VM 1 of a cuff pulse wave is computed in SB5 corresponding to the propagation velocity calculation means 84 based on the time difference TDRP. And after being judged in SB10 corresponding to [that the mutual change value which this propagation velocity VM 1 adjoined is below a predetermined value] the change value judging means 86 Finally it is determined as propagation velocity VM 2 of the pulse wave to which the average for three beats spreads the inside of a living body's artery in SA11 corresponding to the propagation velocity decision means 87 from the beginning of the propagation velocity VM 1 of the cuff pulse wave serially computed in SB5. Therefore, it is not concerned with change of the compression pressure force of a cuff 15, but since the pulse wave velocity VM 1 in a field as the pulse wave velocity VM 1 computed serially always shows abbreviation constant value in is finally determined as pulse wave velocity VM 2, the accuracy of measurement of pulse wave velocity is raised.

[0043] Moreover, fixed blood-pressure value BPt which was beforehand set up from the formula 2 memorized beforehand in SA13 corresponding to the correction propagation velocity calculation means 89 based on the lowest-blood-pressure value DBP and pulse rate HR which were determined in SA8 corresponding to said blood-pressure decision means 80 according to this example And pulse rate HRt The correction propagation velocity VM 3 corrected to the value which can be set (normalization) is computed. therefore, the pulse wave velocity which will be computed by this equipment even if it differs somewhat, whenever a living body's blood-pressure value and pulse rate measure -- up Norikazu -- since the correction propagation velocity VM 3 in the blood-pressure value and pulse rate of a law normalizes, it becomes possible to use the measured pulse wave velocity directly as an index showing a change of whenever [arteriosclerosis / of an operating personnel-ed] with time.

[0044] And the correction propagation velocity VM 3 measured by this equipment In SA12 corresponding to the coefficient value decision means 88, it is based on the formula 3 memorized beforehand. Since it is computed using the coefficient A determined from the lowest-blood-pressure value DBP measured in the propagation velocity VM1 and SA8 computed in SB5, i.e., the coefficient which also considered the effect by the individual difference of whenever [arteriosclerosis] It becomes possible to use the measured pulse wave velocity as an index showing the individual difference of whenever [arteriosclerosis].

[0045] Moreover, since according to this example pulse wave velocity is also measured by blood pressure measurement and coincidence and the pulse wave velocity is moreover converted as what has possible using directly as an index showing a change of whenever [arteriosclerosis] with time, much biological information will be offered by the operating personnel-ed, and it becomes possible to judge health condition on many sides. Moreover, since trend graphical representation of whenever [corresponding to the pulse wave velocity computed / arteriosclerosis] is carried out, a change with time can be grasped simpler and correctly.

[0046] Moreover, the former and pulse wave velocity take remarkable skill to look for the optimal press, since it was measured by equipping a carotid artery and a crotch artery with a pulse wave sensor using the fastener of dedication, and although it was quite difficult for the operating personnel-ed itself to measure, since they can measure pulse wave velocity easily, without requiring especially skill, according to the automatic blood-pressure-measurement equipment 8 of this example, measurement of them by the operating personnel-ed itself is attained.

[0047] Moreover, the correction propagation velocity VM 3 computed is the fixed blood-pressure value BPt set up beforehand. And pulse rate HRt Fixed blood-pressure value BPt beforehand set up based on the formula 8 since it was corrected to the value which can be set Much more exact evaluating becomes possible only for the part whose effect by the pulse rate is lost as compared with what was corrected to the value which can be set.

[0048]

[Equation 8] VM3=VM2+A(BPt -DBP)

[0049] Moreover, after being judged by SB10 corresponding to [that the change value of the above-mentioned propagation velocity VM 1 turned into below the predetermined value] the change value judging means 86 according to this example Based on the propagation velocity VM 1 of two or more pulse waves serially computed by SB5 corresponding to the propagation velocity calculation means 84, from a formula 4 by SB12 corresponding to the anticipation propagation velocity decision means 90 Anticipation propagation velocity VM1' of the cuff pulse wave it is expected to be to be computed is determined, and by next, SB13 corresponding to the pulse wave correction means 92 It is based on difference deltaVM1 with the propagation velocity VM 1 of this anticipation propagation velocity VM1' and the cuff pulse wave actually computed by SB5. amplitude value X1 computed from the formula 6 set up beforehand only -- whether it is added to the amplitude value of the cuff pulse wave by which this propagation velocity VM 1 was computed or pressure value X2 computed from the formula 7 set up beforehand only -- correction of the cuff pulse wave used for SA8 corresponding to said blood-pressure decision means is made by being added to the cuff pressure value at the time of generating of this cuff pulse wave. Therefore, since amendment of a blood-pressure value is suitably performed even if a blood-pressure value changes with a certain situations for every heartbeat during blood pressure measurement, an always exact blood-pressure value decision is made, and it is lost that the serious effect for blood-pressure-measurement precision is done.

[0050] Moreover, when the above-mentioned propagation velocity VM 1 exceeds the field in the predetermined tolerance which the propagation velocity VM 1 beforehand set up for every compression pressure force value of said cuff 15 can take, i.e., the dashed line of drawing 5 , according to this example, the blood-pressure decision by SA8 corresponding to the blood-pressure decision means 80 is terminated by SB6 corresponding to the blood-pressure decision termination means 94. Therefore, since blood-pressure value decision is terminated by the change far exceeding a permissible dose when unusual even if a blood-pressure value changes with a certain situations for every heartbeat during blood pressure measurement, it is lost that the serious effect for blood-pressure-measurement precision is done.

[0051] As mentioned above, although one example of this invention was explained based on the drawing, this invention is applied also in other modes.

[0052] For example, in the above-mentioned example, although pulse wave velocity VM 1 was computed based on the time difference TDRP from the R wave of an electrocardio induction wave to [from a formula 1] the bottom peak point of a cuff pulse wave the time difference TDRP may be defined as versatility, such as time difference from the time difference from the Q wave or S wave of an electrocardio induction wave to the point that only predetermined amplitude value recovered from the bottom peak point of a cuff pulse wave, the Q wave of an electrocardio induction wave, or an R wave to the point of a cuff pulse wave inclining [maximum].

[0053] Moreover, it sets to the formula 1 of the above-mentioned example, and is TPEP. Although it defined as a precursive appearance period (sec) from the R wave of an electrocardio induction wave to the bottom peak point of a cuff pulse wave, you may define as a precursive appearance period from the Q wave or S wave of an electrocardio induction wave to the bottom peak point of a cuff pulse wave. Since the mutual time difference between Q in an electrocardio wave, R points, and S points is very few values, it does not interfere, even if it defines like the above-mentioned example.

[0054] Moreover, in the above-mentioned example, although it was constituted so that a right arm 12 might be inserted in a through hole 14, it does not interfere, even if it is constituted so that the left arm 13 may be inserted in a through hole 14, and a through hole 14, the 1st armrest 17, and 2nd armrest 19 grade are prepared in the location of a left dextrotorsion pair in this case. Furthermore, in the above-mentioned example, although the 1st armrest 17 was inclined and formed upward, it may be independently prepared in the shape of level, and the 2nd armrest may be inclined and formed upward in reverse. What is necessary is to just be designed so that the condition that muscles loosened can be kept good in short.

[0055] Moreover, in the above-mentioned example, although the electrode 18 was formed in the point of the 1st armrest 17 and the 2nd armrest 19, it does not independently need to be restricted to this location and may be changed into various installation locations by a configuration, an installation, etc. of an armrest. What is necessary is to just be installed so that the electrocardio induction wave stabilized from a right arm 12 and the left arm 13 can be detected in short.

[0056] Moreover, although the automatic blood-pressure-measurement equipment 8 of the format that a cuff 15 is automatically rolled and fastened on the arm of an operating personnel-ed in the above-mentioned example was adopted The automatic blood-pressure-measurement equipment of format which an operating personnel-ed rolls and fastens on an arm by itself may be adopted independently. Moreover, an electrocardio induction wave It does not independently need to be detected from the electrode prepared on the armrest, and it may be constituted so that it may be contacted for

example, detected from a sucker-like electrocardio electrode in the predetermined part of a living body as usual.
[0057] Moreover, the correction propagation velocity VM 3 computed in the above-mentioned example is the fixed blood-pressure value BPt set up beforehand. And pulse rate HRt Fixed blood-pressure value BPt to which the correction propagation velocity VM 3 computed was beforehand set based on the formula 8 although corrected to the value which can be set It may be corrected only to the value which can be set. Since the effect a pulse rate affects pulse wave velocity is not so large as the effect which a blood-pressure value does, required sufficient effect is still acquired.
[0058] Moreover, it replaces with the formula 3 of the above-mentioned example, and a formula 9 may be used. The coefficient A which is proportional to propagation velocity VM 2, and is in inverse proportion to the lowest-blood-pressure value DBP in short should just be computed.
[0059]
[Equation 9]

$$A = \frac{BV_{M2}}{C\ (DBP)} + D$$

[0060] Moreover, in SA15 of the above-mentioned example, although the list 104 of whenever [arteriosclerosis] and the trend graph 106 were displayed, it may be constituted so that the correction propagation velocity VM 3 may be displayed on a list 104 and the trend graph 106 as it is.
[0061] Moreover, after being judged with the change value of the propagation velocity VM 1 of the cuff pulse wave serially computed in SB5 being below a predetermined value in the above-mentioned example in SB10 Although determined as propagation velocity VM 2 of the pulse wave to which the average for three beats spreads the inside of a living body's artery in SA11 corresponding to the propagation velocity decision means 87 from the beginning of the propagation velocity VM 1 of the cuff pulse wave serially computed in SB5 ******** of the propagation velocity VM 1 for one beat extracted by not the average but arbitration may be determined as propagation velocity VM 2, and it does not matter since precision is increased more, even if propagation velocity VM 2 is computed from the average for more numbers of beats than three beats.
[0062] In the above-mentioned example, moreover, by using a formula 4 in SB12 based on two or more propagation velocity VM 1 memorized in the 2nd storage region of RAM66 That is, although anticipation propagation velocity VM1' of the cuff pulse wave it is expected to be to be computed next is serially determined using the moving average. deviation, it may be constituted so that the so-called regression line may be used instead of a moving average deviation and anticipation propagation velocity VM1' of a cuff pulse wave may be determined.
[0063] Moreover, in the above-mentioned example, although the blood-pressure value was determined based on change of the amplitude of the cuff pulse wave extracted in the **** pressure-lowering process in which the pressure of the compression pressure force of a cuff 15 is made to lower gently, it may be constituted so that a blood-pressure decision may be made based on the cuff pulse wave extracted in the **** pressure-up process to which the pressure up of the compression pressure force of a cuff 15 is carried out gently.
[0064] Moreover, in the above-mentioned example, although a blood-pressure value decision by the oscillograph metric method was made, even if it is constituted so that a blood-pressure value decision by the Korotkoff-sounds method may be made, the same effect can be acquired.
[0065] In addition to this in the range in which this invention does not deviate from the main point, various modification may be added.

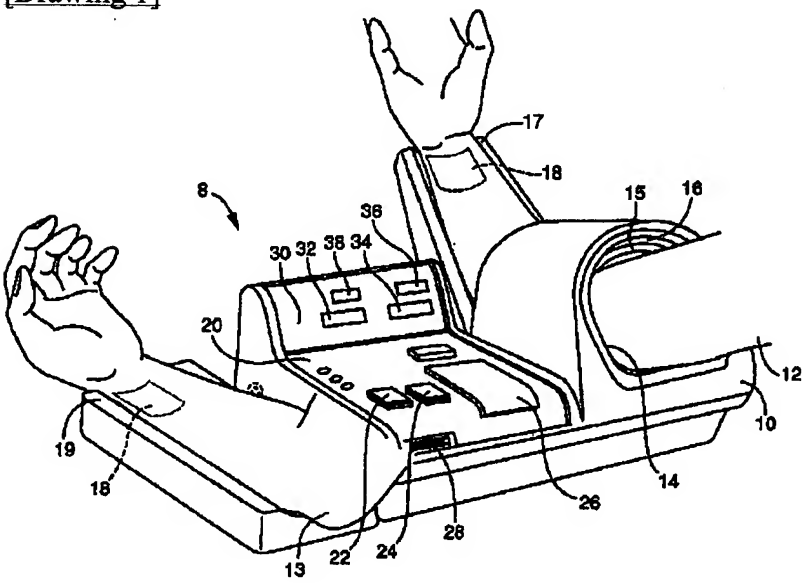
[Translation done.]

* NOTICES *

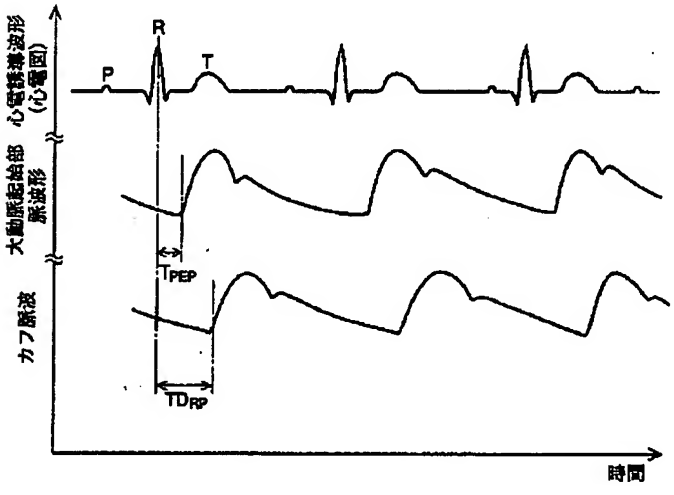
1.This document has been translated by computer. So the translation may not reflect the original precisely.
2.**** shows the word which can not be translated.
3.In the drawings, any words are not translated.

DRAWINGS

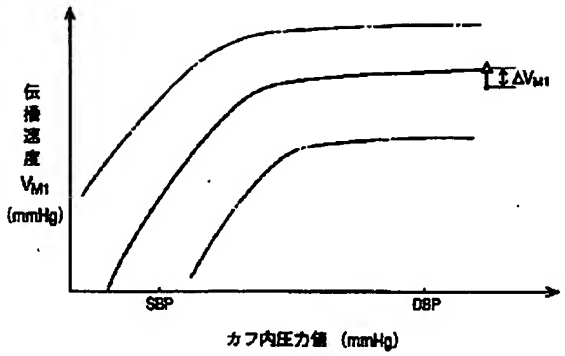
[Drawing 1]



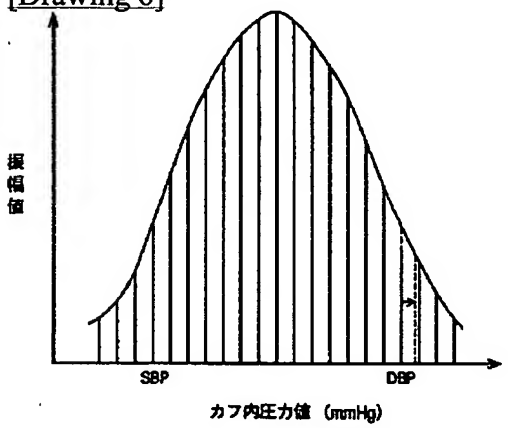
[Drawing 4]



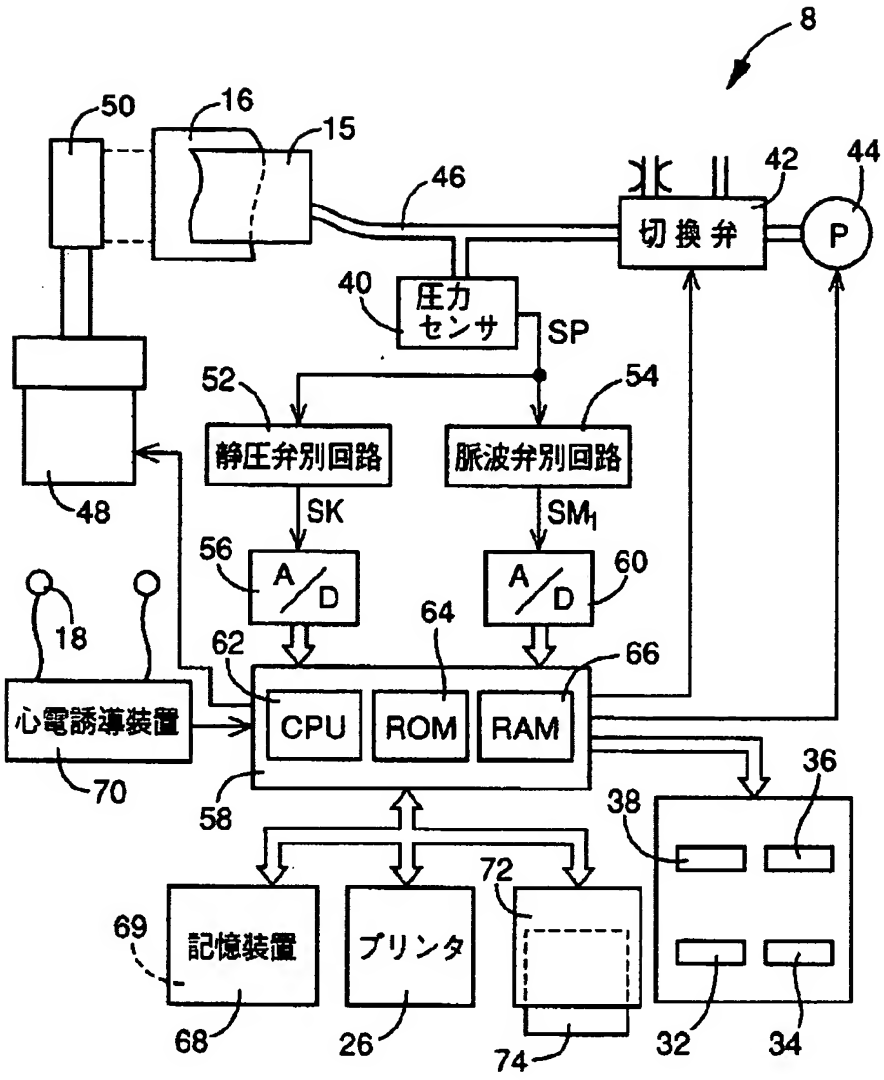
[Drawing 5]



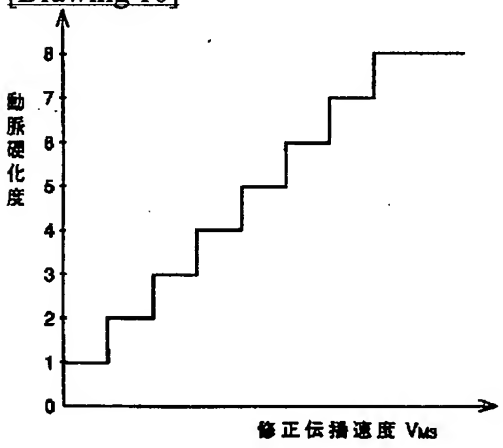
[Drawing 6]



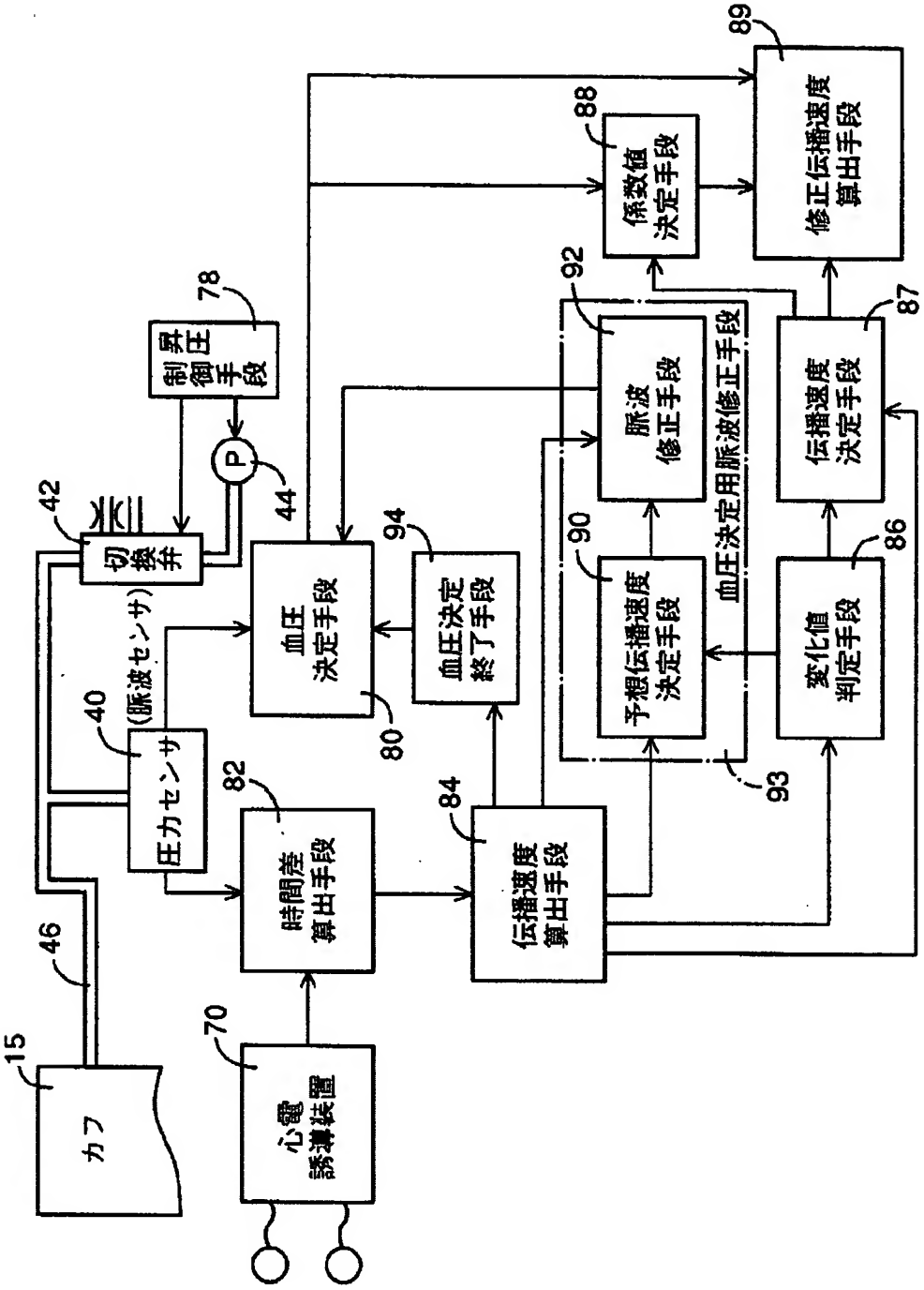
[Drawing 2]



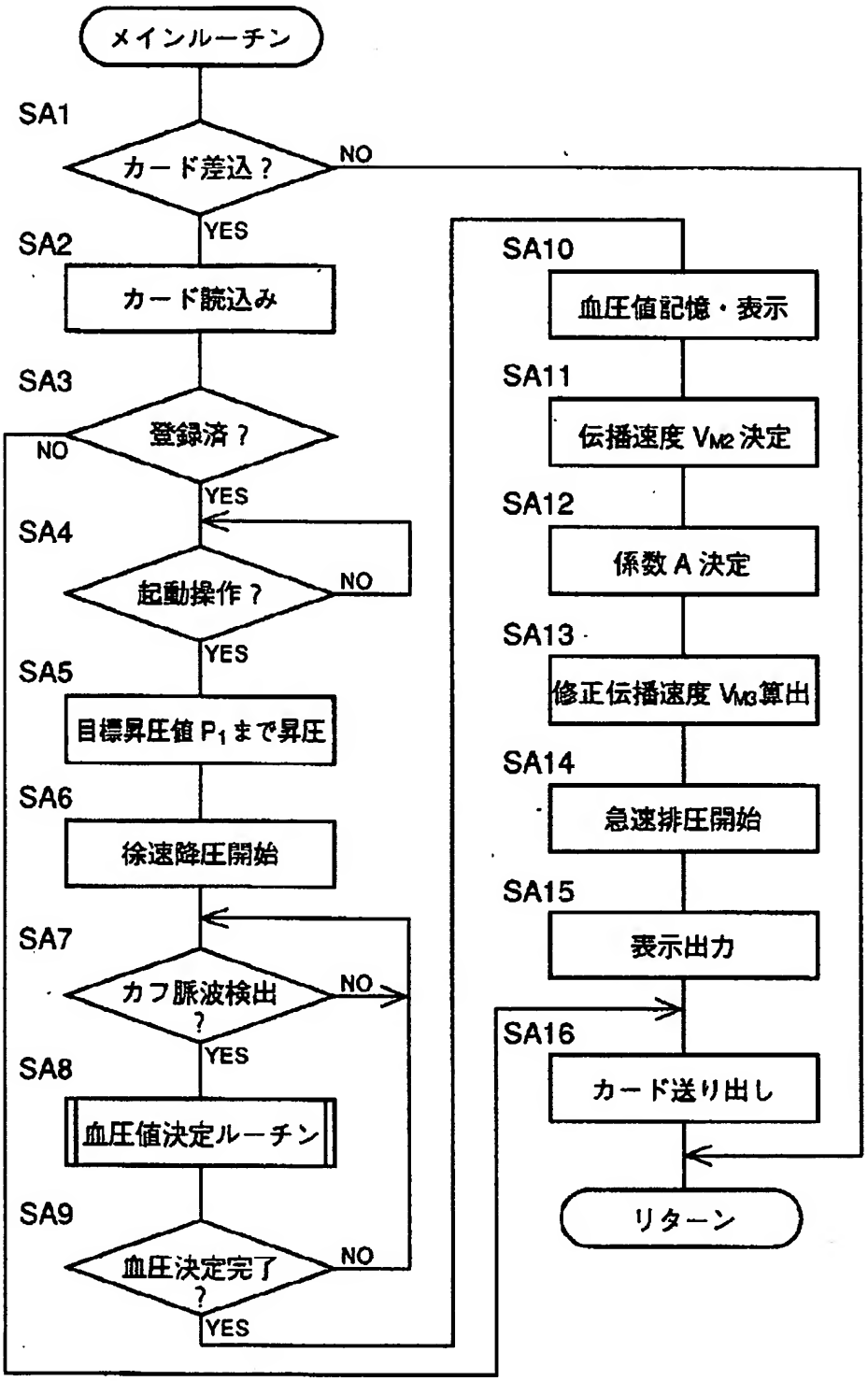
[Drawing 10]



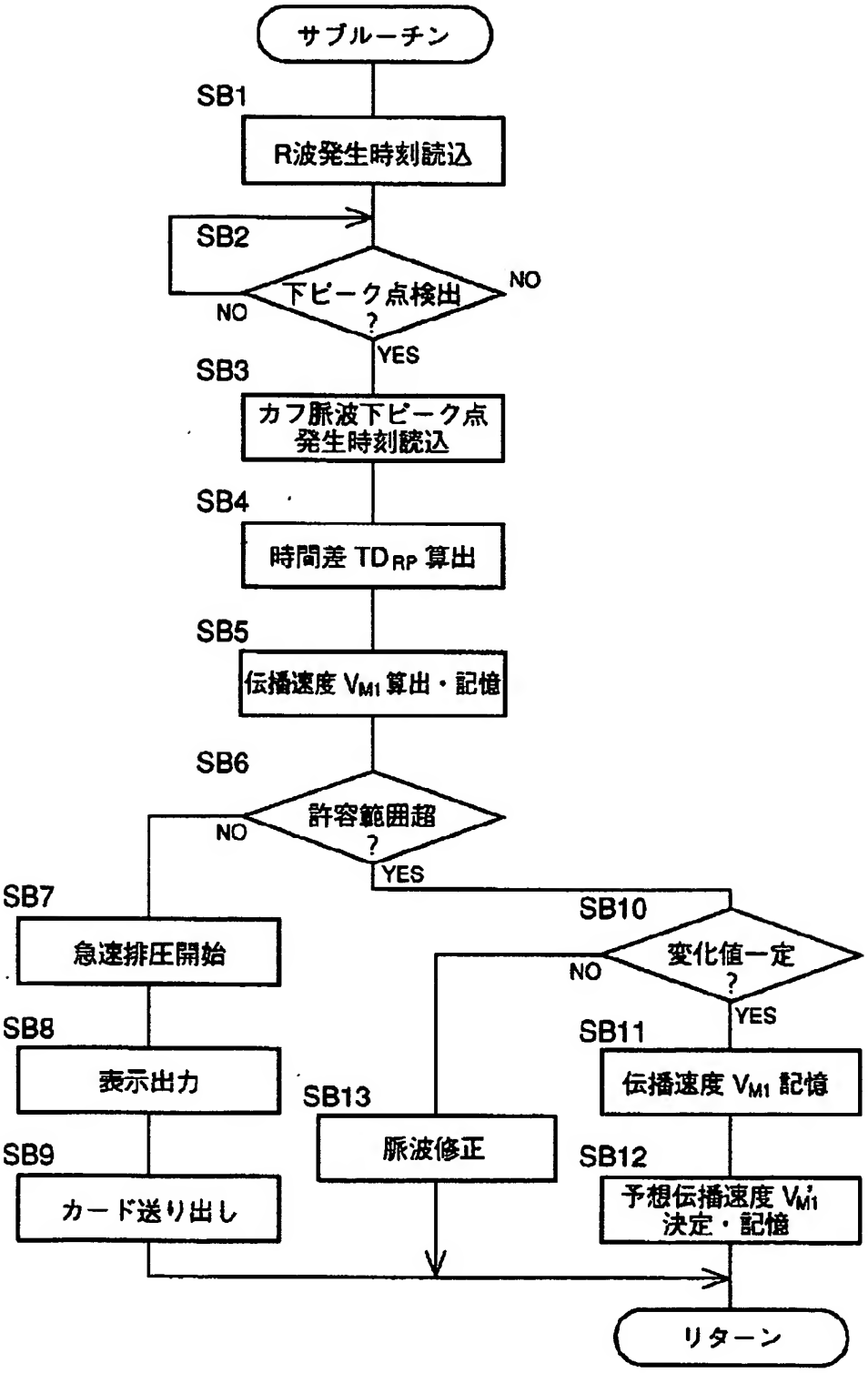
[Drawing 3]



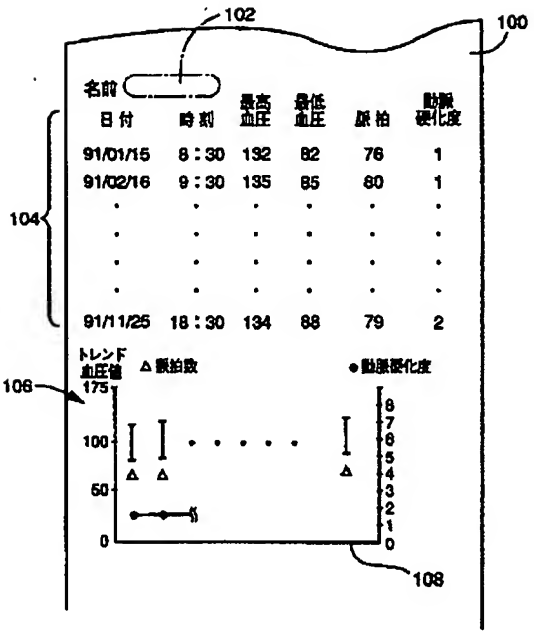
[Drawing 7]



[Drawing 8]



[Drawing 9]



[Translation done.]